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Manipulating Nanoscale Morphologies in Block Copolymer Thin Films Using Gradient Approaches MING LUO, JONATHAN SEPPALA[1], JULIE ALBERT[2], RONALD LEWIS, III[3], Univ of Delaware, NIKHILA MAHADEVAPURAM, GILA STEIN, Univ of Houston, THOMAS EPPS, III, Univ of Delaware
— Controlling the nanostructure of self-assembled block copolymer (BCP) thin films is critical for templating and membrane applications. The surface interactions and commensurability (film thickness) strongly influence the phase behavior of substrate supported BCP thin film. In this work, we employed a gradient approach to examine the effects of substrate surface chemistry and film thickness on the self-assembly of cylinder-forming poly(styrene-*b*-isoprene-*b*-styrene) (SIS) thin films. We identified an interesting phase transformation from parallel cylinders to hexagonally perforated lamellar (HPL) structures on chlorosilane modified substrates, and the through-film morphology was further characterized using ultraviolet ozone (UVO) etching, cross-sectional transmission electron microscopy (TEM) and grazing incidence small angle X-ray scattering (GISAXS) techniques. We demonstrated the use of film thickness and monolayer substrate surface chemistry gradients to manipulate the nanostructure of SIS thin films. These gradients represent a high-throughput screening tool that facilitates the examination of new materials and furthers the understanding of block copolymer thin film self-assembly.

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